

D. Remarks

In the above-identified Office Action, Claim 1 was rejected over the teachings of US Patent 5,228,776 granted to Smith. Claim 1 has been amended to recite limitations that were originally recited in Claim 7, and Claim 7 has been canceled. Applicants note that although originally-filed Claim 7 was rejected (in paragraph 2 on page 2 of the above-identified Office Action) as being anticipated by Smith, the Examiner failed to make a prima facie case of anticipation. Specifically, the Examiner did not identify any citation whatsoever in Smith's patent for the specific limitations recited in originally-filed Claim 7.

Claim 1 (as amended) distinguishes over Smith's teachings for a number of reasons. Applicants submit that there is no disclosure or suggestion in Smith's teachings for use of periodicity in measurements as an indicator of the quality of a conductive structure that is itself periodic in space. In fact Smith fails to disclose or suggest application of heat to a periodic conductive structure. Hence Smith never reaches the issue of periodicity across a group of measurements obtained with such heat application. Instead of disclosing a periodic conductive structure, Smith discloses only one "vertical interconnect or via 26 [that] electrically connects the two metal lines" (see column 2, lines 51-52).

Moreover, Smith appears to teach away from applying his method to a conductive structure that contains multiple features (such as vias in a via chain). Specifically, Smith states (at column 7, lines 6-9) that "the strength of the signal available at the displaced probe beam spot will be severely degraded if there are faults in the lines or vias between the pump and probe beams" (emphasis added). Therefore, the presence of multiple vias (as in a via chain) is likely to worsen the loss of meaningful information in Smith's signal from a single via, as identified by Smith ("any defects in the line will have a major influence on the transmitted signal"; see column 3, lines 63-64). As a small crack in Smith's structure causes a loss of meaningful information about a single via, a via chain is likely to cause a worse loss.

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Hence, a skilled artisan may believe that a periodic via chain structure would create such a perturbation in Smith's signal that any meaningful information therein is lost. Therefore, it appears unlikely that the skilled artisan would believe that a meaningful periodic signal can be obtained from Smith's method when evaluating a conductive structure that has periodic geometry.

Even assuming arguendo that Smith's teachings are applicable to a via chain (although there is no prior art motivation to do so), Smith may at most teach evaluation of one via at a time. Specifically, Smith fails to recognize that a sinusoidal response that is seen across a group of measurements is obtained when evaluating a periodic conductive structure that is non-defective.

In this context, Applicants submit that the teachings of US Patent 6,330,361 granted to Mitchell fail to overcome the above-described defects in Smith's teachings. Specifically, even if Smith's signal were to be converted by a Fourier transform into the frequency domain, the result still lacks periodicity, at least because Smith's signal (that is measured) pertains to only one via.

Furthermore, Applicants respectfully traverse the Examiner's stated motivation for modifying Smith's teachings by use of Mitchell's teachings. Specifically, the Examiner stated that the motivation was "to obtain the result in a digital form ...". However, Applicants submit that Smith's signal could be digitized in the space domain, and a skilled artisan would not see the need to convert Smith's signal into the frequency domain prior to digitizing. Moreover, the Examiner has failed to cite any teaching in Smith's patent for the proposition that Smith's signal in the frequency domain will yield any more useful information than in the space domain.

For one or more of the above-discussed reasons, Applicants submit that Claim 1 is patentable over all the references cited by the Examiner in the above-identified Office Action. The amendments to Claim 1 are supported throughout the originally-filed application, including, for example, page 9 lines 10-19, page 19 lines 12-21, page 21 lines 20-24, and page 22 lines 1-10. In view of the above remarks, Applicants

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respectfully request the Examiner to withdraw the prior art rejection of Claim 1. Applicants further request the Examiner to withdraw the rejection of Claims 2-6, 8-17 and 31 that depend directly or indirectly from Claim 1. Claim 31 is supported at, for example, page 19 lines 19-21 and page 23 lines 17-18.

Applicants submit that the Examiner has also failed to make a prima facie rejection of Claim 3, although Claim 3 was indicated as being anticipated by Smith (see paragraph 2 on page 2 of the above-identified Office Action). Specifically, the Examiner failed to identify a single citation in Smith for use of coincident beams to determine presence/absence of defects. In fact, Smith merely teaches (in column 1, lines 62-63) that optical reflectivity of the sample is to be monitored with the use of coincident beams, without further stating that such measurements can be analyzed for spatial periodicity when evaluating a periodic conductive structure. Claim 3 is therefore patentable for at least this additional reason. New Claims 32 and 33 are also believed to be patentable for a similar reason.

Claim 18 was rejected as being unpatentable over the teachings of Smith when modified by the teachings of Shakouri (US 2002 0126732). In rejecting Claim 18, the Examiner stated that Shakouri teaches that "a phase difference between an excitation beam (pump beam/heat source) and a probe (probe beam/temperature change) is used (inherently measured) to determine a thermal wave propagation through a sample..." (see top of page 7 of the above-identified Office Action). Applicants submit that the Examiner has failed to provide a single citation in Shakouri's teachings for the Examiner's statement, and hence failed to make a prima facie rejection of Claim 18.

Applicants also respectfully traverse the Examiner's motivation for modifying Smith's teachings by use of Shakouri's teachings. Specifically, there appears to be no prior art support for the Examiner's statement that Smith's device should be modified "so as to measure a phase difference between an excitation beam and a probe, in order to use it to determine thermal wave propagation through the sample..." Moreover, the Examiner has not cited any support in Smith's patent for the proposition that

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measurement of a phase difference in Smith's signal could indicate thermal wave propagation.

Claim 18 as amended now requires analyzing whether the phase difference measured is larger than a phase difference of a conductive structure that is non-defective. Support for the amendment to Claim 18 is found at, for example, page 31 at line 14. If the Examiner continues to reject Claim 18, the Examiner is respectfully requested to cite in the next Office Action the specific column number and line number where Shakouri teaches that the phase difference is larger for a defective conductive structure (as compared to a non-defective structure). Claims 19-21 and 34 depend from Claim 18 and are believed to be patentable for at least the same reasons as Claim 18. New Claim 34 is supported at, for example, page 37 lines 8-9.

Claim 22 was rejected over the teachings of Smith in view of US Patent 4,255,971 granted to Rosencwaig. Claim 22 has been amended to state that heat is applied simultaneously to more than one via chain. Support for the amendment to Claim 22 is found throughout the originally-filed application, including, for example, FIG. 10, page 12 lines 6-8, and page 25 lines 17-20. As noted above, Smith appears to teach away from applying his method to a conductive structure that contains multiple features (such as vias in a via chain). And Rosencwaig fails to overcome this defect in Smith's teaching.

Applicants also submit that the Examiner has failed to cite support in the prior art for the Examiner's stated motivation ("to provide the data of the depth of the sample") to modify the teachings of Smith with the teachings of Rosencwaig. Also, there appears to be no support in Smith's teachings that varying the modulation frequency of Smith's beam will provide a full depth profile of Smith's via, contrary to the Examiner's position. Therefore, Claim 22 and its dependent Claims 23-27 are believed to be patentable over the combined teachings of Smith and Rosencwaig.

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For the above reasons, Applicants respectfully request allowance of Claims 1-6 and 8-34. Should the Examiner have any questions concerning this response, the Examiner is invited to call the undersigned at (408) 982-8200, ext. 3.

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| <u>S. Omkar</u> Attorney for Applicant(s) | <u>June 25, 2003</u> Date of Signature |

Respectfully submitted,

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